

<b>14 GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS)</b>	Page 1 of 3
<b>Division of Forensic Science TRACE EVIDENCE TRAINING MANUAL</b>	Amendment Designator:
	Effective Date: 29-March-2004
<p align="center"><b>14 GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS)</b></p> <p><b>14.1 Introduction to Gas Chromatography-Mass Spectrometry (GC-MS)</b></p> <p>14.1.1 Objectives</p> <p>Through completion of this module the trainee will have developed and demonstrated theoretical knowledge and/or practical skills to:</p> <ul style="list-style-type: none"> <li>• Describe the basic theory and draw a basic diagram of the major components of the instrument;</li> <li>• Describe the capabilities and limitations of the instrument;</li> <li>• Describe the practical applications of GC-MS;</li> <li>• Define GC-MS terminology;</li> <li>• Understand and explain the different autotunes available;</li> <li>• Evaluate an instrument autotune to approve instrument for casework; and,</li> <li>• Describe the differences between the library search routines.</li> </ul> <p>14.1.2 Required Readings</p> <p>14.1.2.1 Agilent Technologies. <u>MSD reference collection</u>, computer software, 1999.</p> <p>14.1.2.2 American Society for Mass Spectrometry, <u>What is Mass Spectrometry</u>, Handout, ASMS, 1989.</p> <p>14.1.2.3 HP Student Handbook, <u>MS Fundamentals</u>, 1993, Central Drug Section.</p> <p>14.1.2.4 McLafferty/Turecek, <u>Interpretation of Mass Spectra</u>, 4th edition, University Science Books, 1993, Chapters 1-4.</p> <p>14.1.2.5 Watson, J. Throck, <u>Introduction to Mass Spectrometry (3rd edition)</u>, Lippincott-Raven, New York, 1997, pp. 73-80.</p> <p>14.1.3 Questions</p> <p>The trainee will provide written answers to the following questions:</p> <ul style="list-style-type: none"> <li>• Draw a schematic diagram for a GC-MS and describe the function of each component.</li> <li>• Define the following terms <ul style="list-style-type: none"> <li>○ Scan rate</li> <li>○ Scan cycle time</li> <li>○ Reset time</li> <li>○ Spectral tilting</li> <li>○ Molecular ion</li> <li>○ Base peak</li> <li>○ Electron ionization</li> <li>○ Resolution as it relates to mass spectroscopy</li> </ul> </li> <li>• What is the mass resolution of our instruments?</li> <li>• Why are vacuum conditions necessary in the ionization source, analyzer and detector of the mass spectrometer?</li> <li>• What type of vacuum system do our instruments have? Describe the limitations of this vacuum system.</li> <li>• Describe how a quadrupole mass analyzer works.</li> </ul>	

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<div> <ul style="list-style-type: none"> <li>• Describe how an electron multiplier works.</li> <li>• Describe the difference between full mass scans and selected ion monitoring.</li> <li>• Describe the importance of tuning and explain the data on the daily tune report.</li> <li>• Briefly explain how the 10-peak and PBM library search routines work.</li> </ul> </div> <div> 14.1.4 Practical Exercises </div> <div> 14.1.4.1 The trainer will physically show the trainee all of the components of the GC-MS system. </div> <div> 14.1.4.2 The trainer will demonstrate the autotunes available and provide discussion on the criteria for acceptance of the daily autotune. </div> <div> 14.1.4.3 The trainer will demonstrate and discuss the library search routines. </div> <div> 14.1.5 Evaluation </div> <div> 13.1.4.1 The trainer will review the written answers to the questions with the trainee. </div> <div> 13.1.4.2 The trainer and the trainee will review and discuss the pertinent points of each of the required readings. </div> <div> 13.1.4.3 The trainee will be quizzed orally upon the subject matter. </div> <div> <b>14.2 Sample Preparation and Data Collection</b> </div> <div> 14.2.1 Objectives </div> <div> Through completion of this module the trainee will have developed and demonstrated theoretical knowledge and/or practical skills to: </div> <div> <ul style="list-style-type: none"> <li>• Prepare and inject samples to include gases and liquids.</li> </ul> </div> <div> 14.2.2 Required Readings </div> <div> 14.2.2.1 Trace Evidence Section Standard Operating Procedures for GC-MS. </div> <div> 14.2.3 Questions </div> <div> The trainee will provide written answers to the following questions: </div> <div> <ul style="list-style-type: none"> <li>• Describe differences in the parameters for the analysis of: gases/liquids; strong/weak; and references/standards versus case samples.</li> </ul> </div> <div> 14.2.4 Practical Exercises </div> <div> 14.2.4.1 The trainee will demonstrate the daily and monthly QC procedures for the GC-MS. </div> <div> 14.1.4.2 The trainee will perform the daily QC procedures for the GC-MS for a minimum of one week. </div> <div> 14.1.4.3 The trainee will demonstrate headspace and liquid injections. </div> <div> 14.1.4.4 The trainee will demonstrate how to set-up the instrument for single as well as autosampler injections including daily QC checks. </div>	

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<p>14.1.4.5 The trainee will inject samples that are relevant to or a part of their subdiscipline training.</p> <p>14.2.5 Evaluation</p> <p>14.2.5.1 The trainer will review the written answers to the questions with the trainee.</p> <p>14.2.5.2 The trainer and the trainee will review and discuss the pertinent points of each of the required readings.</p> <p>14.2.5.3 Review of practical exercises.</p> <p><b>14.3 Competency Evaluation and Mock Trial</b></p> <p>The trainee will use GC-MS when completing their subdiscipline competency test and will defend their results as a part of their mock trial in that subdiscipline.</p> <p><b>14.4 GC-MS Operator Trainees</b></p> <p>14.4.1 The GC-MS operator trainee will demonstrate the ability to perform routine maintenance on the instrument to include as a minimum; cleaning of the source, GC column replacement and basic troubleshooting.</p> <p>14.4.2 The GC-MS operator trainee will demonstrate a greater in-depth working knowledge of the instrument than a GC-MS user in order to provide training to individual users.</p> <p>14.4.3 The GC-MS operator trainee will prepare a presentation which will be presented to a group consisting of at least, qualified trace evidence examiners who use GC-MS. The presentation will, at a minimum, include: drawing a schematic of the instrument; an explanation of the GC-MS components; a discussion regarding different autotune routines, data collection and manipulation, library search routines and Trace Evidence specific applications.</p> <p>The GC-MS operator trainee will field questions regarding all aspects of their GC-MS training.</p> <p><b>14.5 Reading List</b></p> <p>14.5.1 Agilent Technologies. <u>MSD reference collection</u>, computer software, 1999.</p> <p>14.5.2 American Society for Mass Spectrometry, <u>What is Mass Spectrometry</u>, Handout, ASMS, 1989.</p> <p>14.5.5 HP Student Handbook, <u>MS Fundamentals</u>, 1993, Central Drug Section.</p> <p>14.5.4 McLafferty/Turecek, <u>Interpretation of Mass Spectra</u>, 4th edition, University Science Books, 1993.</p> <p>14.5.5 Trace Evidence Section Standard Operating Procedures for GC-MS.</p> <p>14.5.6 Watson, J. Throck, <u>Introduction to Mass Spectrometry (3rd edition)</u>, Lippincott-Raven, New York, 1997.</p> <p align="right"><b>◀End</b></p>	